In the Claims:

1. (currently amended) A rotary position measuring system in accordance with the interferential operating principle, comprising:

a housing;

a scanning unit connected with the housing and comprising a light source that emits beams of light and a detector element;

a reflection scanning graduation structure arranged directly on the housing opposite the scanning unit;

a graduated disk that is connected with a rotatable shaft and comprising a radial transmission measuring graduation structure, wherein the graduated disk is arranged so it is rotatable around an axis of symmetry in the housing so that the measuring graduation structure is located between the scanning unit and the scanning graduation structure; and

wherein the beams of light emitted by the light source first reach the measuring graduation structure where they are transmitted via a graduation of the measuring graduation structure a first time and split into a first set of diffracted partial beams of different orders, the diffracted partial beams impinge on the scanning graduation structure, where under reflection a second set of diffracted partial beams of different orders results and a back-reflection of the second set of diffracted partial beams in the direction toward the measuring graduation structure results, so that in effect the beams of light emitted by the light source are transmitted a second time through the same graduation of the measuring graduation structure, subsequent to the first time, wherein the beams of light transmitted the second time are directed along a direction that is opposite to a direction of transmission of the beams of light transmitted the first time and where

the second set of diffracted partial beams interfere with one another and the detection of interfering partial beams takes place by the detector element.

2. (previously presented) The rotary position measuring system in accordance with claim 1, wherein said scanning graduation structure is arranged on a part of the housing which is insensitive against oscillations.

3. (original) The rotary position measuring system in accordance with claim 1, wherein the scanning graduation structure is fastened flat on the housing.

4. (original) The rotary position measuring system in accordance with claim 2, wherein the scanning graduation structure is fastened flat on the housing.

5. (original) The rotary position measuring system in accordance with claim 3, wherein the scanning graduation structure is fastened by gluing on the housing.

6. (original) The rotary position measuring system in accordance with claim 1, wherein the scanning graduation structure is only arranged in one segment of a circle.

7. (original) The rotary position measuring system in accordance with claim 1, wherein the scanning graduation structure is arranged in a circular ring on the housing.

8. (original) The rotary position measuring system in accordance with claim 1, wherein the scanning graduation structure is an integral part of the housing.

9. (original) The rotary position measuring system in accordance with claim 8, wherein the scanning graduation structure is formed as an etched structure on the housing.

10. (original) The rotary position measuring system in accordance with claim 1, wherein the scanning graduation structure is formed as a stamping on a thin foil, and the foil is arranged flat on the housing.

11. (original) The rotary position measuring system in accordance with claim 1, wherein a screen structure in the form of an absorbent layer is arranged adjacent to the scanning graduation structure.

12. (original) The rotary position measuring system in accordance with claim 1, wherein the housing is designed in a cylinder shape and comprises a flange on which the scanning graduation structure is arranged.

13. (currently amended) A rotary position measuring system in accordance with the interferential operating principle, comprising:

a housing;

a scanning unit connected with the housing and comprising a light source that emits

beams of light and a detector element;

a reflection scanning graduation structure arranged directly on the housing opposite the scanning unit;

a graduated disk that is connected with a rotatable shaft and comprising a radial transmission measuring graduation structure, wherein the graduated disk is arranged so it is rotatable around an axis of symmetry in the housing so that the measuring graduation structure is located between the scanning unit and the scanning graduation structure, and wherein the measuring graduation structure comprises a phase grating with alternatingly arranged bars and gaps, and wherein either $b_{SM} = 1/3\ TP_M$ or $b_{SM} = 2/3\ TP_M$ applies for the bar width b_{SM}, wherein TP_M identifies the graduation period of the phase grating; and

wherein the beams of light emitted by the light source first reach the measuring graduation structure where they are transmitted a first time via a graduation of the measuring graduation structure and split into a first set of diffracted partial beams of different orders, the diffracted partial beams impinge on the scanning graduation structure, where under reflection a second set of diffracted partial beams of different orders results and a back-reflection of the second set of diffracted partial beams in the direction toward the measuring graduation structure results, so that in effect the beams of light emitted by the light source are transmitted a second time through the same graduation of the measuring graduation structure, subsequent to the first time, wherein the beams of light transmitted the second time are directed along a direction that is opposite to a direction of transmission of the beams of light transmitted the first time and where the second set of diffracted partial beams interfere with one another and the detection of interfering partial beams takes place by the detector element.

14. (original) The rotary position measuring system in accordance with claim 13, wherein the bar height of the measuring graduation structure, h_{SM}, is defined by the equation h_{SM} $(n -1) = \lambda /3$, wherein n identifies the refractive index of the bar material, while λ identifies the wavelength of the light source used.

15. (original) The rotary position measuring system in accordance with claim 14, wherein the scanning graduation structure comprises a phase grating with alternatingly arranged bars and gaps, and the bar width b_{SA} equals the gap width b_{LA}.

16. (original) The rotary position measuring system in accordance with claim 15, wherein the bar height of the scanning graduation structure, h_{SA}, is defined by the equation $h_{SA} = \lambda /4$, wherein λ identifies the wavelength of the light source used.

17. (currently amended) A rotary position measuring system in accordance with the interferential operating principle, comprising:

a housing;

a scanning unit connected with the housing and comprising a light source that emits beams of light and a detector element, wherein the scanning unit is arranged on a circular plate which is connected via lateral housing walls with the housing;

a reflection scanning graduation structure arranged directly on the housing opposite the scanning unit;

a graduated disk that is connected with a rotatable shaft and comprising a radial

transmission measuring graduation structure, wherein the graduated disk is arranged so it is rotatable around an axis of symmetry in the housing so that the measuring graduation structure is located between the scanning unit and the scanning graduation structure; and

wherein the beams of light emitted by the light source first reach the measuring graduation structure where they are transmitted a first time via a graduation of the measuring graduation structure and split into a first set of diffracted partial beams of different orders, the diffracted partial beams impinge on the scanning graduation structure, where under reflection a second set of diffracted partial beams of different orders results and a back-reflection of the second set of diffracted partial beams in the direction toward the measuring graduation structure results, so that in effect the beams of light emitted by the light source are transmitted a second time through the same graduation of the measuring graduation structure, subsequent to the first time, wherein the beams of light transmitted the second time are directed along a direction that is opposite to a direction of transmission of said beams of light transmitted said first time and where the second set of diffracted partial beams interfere with one another and the detection of interfering partial beams takes place by the detector element.

18. (original) The rotary position measuring system in accordance with claim 1, wherein the scanning graduation structure is arranged on a compensating body on the housing, and the compensating body is connected in a manner fixed against relative twisting and radially displaceable with the housing.

19. (previously presented) The rotary position measuring system in accordance with claim 1, wherein the measuring graduation structure is radially symmetrically arranged around the axis of symmetry.

20. (previously presented) The rotary position measuring system in accordance with claim 1, wherein tilting or tumbling of said scanning graduation structure with respect to said measuring graduation structure does not affect a position of position-dependent signals received by said detector element.

21. (previously presented) The rotary position measuring system in accordance with claim 1, wherein a neutral point lies in a plane defined by said graduated disk, wherein said neutral point is defined to be a point around which either said measuring graduation structure or said scanning unit inclusive of said reflection scanning graduation structure can be pivoted within a defined tolerance range without affecting a position of position-dependent signals received by said detector element.

22. (previously presented) The rotary position measuring system in accordance with claim 13, wherein tilting or tumbling of said scanning graduation structure with respect to said measuring graduation structure does not affect a position of position-dependent signals received by said detector element.

23. (previously presented) The rotary position measuring system in accordance with claim 13, wherein a neutral point lies in a plane defined by said graduated disk, wherein said neutral point is defined to be a point around which either said measuring graduation structure or said scanning unit inclusive of said reflection scanning graduation structure can be pivoted within a defined tolerance range without affecting a position of position-dependent signals received by said detector element.

24. (previously presented) The rotary position measuring system in accordance with claim 17, wherein tilting or tumbling of said scanning graduation structure with respect to said measuring graduation structure does not affect a position of position-dependent signals received by said detector element.

25. (previously presented) The rotary position measuring system in accordance with claim 17, wherein a neutral point lies in a plane defined by said graduated disk, wherein said neutral point is defined to be a point around which either said measuring graduation structure or said scanning unit inclusive of said reflection scanning graduation structure can be pivoted within a defined tolerance range without affecting a position of position-dependent signals received by said detector element.